NON-PUBLIC?: N

ACCESSION #: 9109050166
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Braidwood 2 PAGE: 1 OF 04

DOCKET NUMBER: 05000457

TITLE: Reactor Trip Caused by Rod Control System Failure
EVENT DATE: 08/01/91 LER #: 91-003-00 REPORT DATE: 08/30/91

OTHER FACILITIES INVOLVED: None DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 088

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: R. Zagrzebski, Technical Staff TELEPHONE: (815) 458-2801
Engineer Ext. 2760

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: AA COMPONENT: ECBD MANUFACTURER: W120
REPORTABLE NPRDS: YES

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

Unit 2 was operating at 88% reactor power in a coast down mode at the end of core life. On August 1, 1991 at 2354 the unit operator attempted to move the control rods in Bank D to control Reactor Coolant System temperature. A Rod Drive (RD) System failure released numerous control rods and allowed them to fall into the core. A reactor trip signal was generated because the Nuclear Instrumentation (NR) System detected a rapid power decrease. Control Room personnel immediately recognized and responded to the reactor trip. The unit was stabilized with normal post-trip response conditions. During RD troubleshooting, the logic cabinet was analyzed to determine the amount of electric current being supplied to the stationary and movable grippers. The 2BD slave cycler was intermittently giving erratic current demand orders. The rods dropped because the stationary gripper was unable to hold the rods before the moving gripper unlatched. The cause of the 2BD slave cycler failure

was a defective binary counter. The counter is required to properly sequence the energization/de-energization of the movable and stationary grippers during rod notion. The 2BD slave cycler binary counter circuit card was replaced. The logic cabinet slave cycler circuits were tested and analyzed for proper operation. A complete functional check of the RD system identified no further deficiencys. To improve RD system performance, a long-term corrective action plan was developed. An evaluation of the effects of high temperatures on the RD system is in progress.

0052m(082391)/2

END OF ABSTRACT

A. PLANT CONDITIONS PRIOR TO EVENT:

Unit: Braidwood 2; Event Date: August 1, 1991; Event Time: 2354;

Mode: 1 - Power Operation; Rx Power: 88%;

RCS AB! Temperature/Pressure: NOT/NOP degrees F/ psig

B. DESCRIPTION OF EVENT:

There were no systems or components inoperable at the beginning of the event which contributed to the severity of the event. The unit was operating in a steady state condition at the end of core life for Cycle 2.

On August 1, 1991 at 2354 the unit operator attempted to move the control rods in Bank D to control Reactor Coolant System temperature. A reactor trip signal was generated because the Nuclear Instrumentation (NR) IG! System detected a rapid power decrease. The power change was caused by a large amount of negative reactivity added to the core. A Rod Drive (RD) AA! System failure released numerous control rods and allowed them to fall into the core.

Control Room personnel immediately recognized the reactor trip and Braidwood Emergency procedure 2BwEP E-0 "Reactor Trip or Safety Injection" was implemented. The unit stabilized and a transition to 2BwES 0.1 "Reactor Trip Response" occurred at 2357. Stable plant conditions were achieved on August 2, 1991 at 0017.

The appropriate NRC notification via the ENS phone system was made at 0112 pursuant to 10CFR50.72(b)(2)(ii).

This event is being reported pursuant to 10CFR50.73(a)(2)(iv) - any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature, including the Reactor Protection System.

C. CAUSE OF EVENT:

When the operator attempted to move the control rods, prior to the reactor trip, outward movement was being demanded for the Group 2 rods in Control Bank D. The rods in this group are controlled by the 2BD power cabinet. After the reactor trip, all power cabinets except 1BD indicated that an "Urgent Failure" alarm had occurred. This alarm is expected on a reactor trip for all power cabinets. However, the 1BD power cabinet moving regulation failure did not actuate as expected.

During troubleshooting, the logic cabinet was cycled to simulate control rod notion. This was done to analyze the amount of electric current being supplied to the stationary and movable grippers. The 2BD slave cycler was intermittently giving erratic current demand orders. The moving gripper was energized at full current and the stationary gripper had no current. This current order from the 2BD slave cycler was followed by the moving gripper with no current and the stationary gripper having reduced current. This caused the rods to drop because the stationary gripper was unable to hold the rods before the moving gripper unlatched. No logic error is generated because the reference voltage signal was not zero for both grippers at the same time. If a logic error had been detected, then an alarm in the rod control system would have energized both the stationary and movable grippers. This would have prevented the rods from falling.

The cause of the 2BD slave cycler circuitry failure was a defective binary counter. The counter is required to properly sequence the energization/de-energization of the movable and stationary grippers during rod notion. This failure was unable to be detected by the rod drive system alarm circuitry. The rod drive system is in a room that does not have air-conditioning. The cause of the counter failure was attributed to elevated local temperatures present in the

room.

D. SAFETY ANALYSIS:

This event had no effect on the safety of the plant or the public. All systems operated as designed in response to the high negative flux rate signal. This event is analyzed in the Updated Final Safety Analysis Report. A single dropped control rod bank typically results in a negative reactivity addition of greater than 5E-3 Delta K/K which will be detected by the NR system power range detectors. The reactor is tripped within approximately 2.5 seconds following the drop of the control rod bank. The core is not adversely affected during this period, since power is decreasing rapidly.

E. CORRECTIVE ACTIONS:

The 2BD slave cycler binary counter circuit card was replaced. All logic cabinet slave cycler circuitry was tested and analyzed for proper operation. No problems were identified after circuit card replacement and a complete functional check of the RD system identified no further defiencies.

The 1BD moving regulation circuit card was replaced because it did not activate the urgent failure alarm for the power cabinet. This card was not the cause of the reactor trip and was replaced as a precautionary measure.

The 2BD lift firing circuit card was replaced because it did not process the cycle signal between the 2BD power cabinet and the logic cabinet. This card was not the cause of the reactor trip and was replaced as a precautionary measure.

The 2BD alarm circuit card which contains the logic error circuitry was replaced because a bench test voltage was near a tolerance limit. This card was not the cause of the reactor trip and was replaced as a precautionary measure.

Three additional firing cards were replaced during this testing due to slight degradation of the oscillator circuitry switching amp output.

Temporary Alteration 88-1-032 installed auxiliary cooler units to provide increased air flow and cooling to the rod drive system power and logic cabinets. An evaluation of the adequacy of the auxiliary cooling units is in progress. Room temperature and humidity level are being trended by SPP 91-037 "Rod Drive Spot Cooler Temporary

Alteration 88-1-032 Monitoring." This item is being tracked to completion by Action Item No. 457-200-88-08705.

An anlysis was performed on the possible differences between the cooling mechanisms for Byron versus Braidwood Stations with reference to the Control Rod Drive Cabinets. This change analysis showed some minor differences. These differences are being considered in the RD system action plan.

An RD system action plan was developed to improve the performance. The following actions are being considered:

1. Improve the cooling of the circuit control cards in the logic and power cabinets.

a. Installation of flanges to improve airflow distribution inside the cabinets. Evaluation of the need to increase the number of auxiliary cooler units. Changing the placement of the discharge ducts to the bottom of the cabinets.

b. Nuclear Engineering will review the room ventilation design and provide recommendations for improvement.

2. Compile a list of in-service circuit control cards in the logic cabinet (74 total cards) and power cabinets (100 total cards) to determine the length of time that the cards have been in service.

a. Instrument Maintenance will determine which cards are original and which have been installed as replacements.

3. Compile maintenance history for Braidwood Station, Zion Station, and Byron Station control rod drive systems.

a. Maintenance Staff Group to search and evaluate.

b. Nuclear Engineering will evaluate system performance.

4. Review NUREG/CR-5555 (Aging Assessment of the Westinghouse PWR Control Rod Drive System) and other industry experience.

5. Check availability of replacement circuit cards.

6. Evaluate the need for and availability of Westinghouse system maintenance assistance during the next refueling outages for both units.

7. Review the preventative maintenance program for the RD system, enhance as necessary.

8. Investigate the differences between the ventilation systems at Braidwood Station and Byron Station. This includes a check of the auxiliary cooler units and their relative effectiveness.

F. PREVIOUS OCCURRENCES:

LER 91-007; "Rod Control System Failure causes Shutdown Bank Control Rods to be in a Condition Prohibited by Technical Specifications"
Docket 50-456

LER 88-009; "Manual Reactor Trip Due to Inoperable Rod Control System"
Docket 50-457

G. COMPONENT FAILURE DATA:

Manufacturer Nomenclature MFG Part Number
Westinghouse Binary Counter 3360C94G01

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Commonwealth Edison
Braidwood Nuclear Power Station
Route #1, Box 84
Braceville, Illinois 60407
Telephone 815/458-2801

August 28, 1991
BW/91-0692

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Dear Sir:

The enclosed Licensee Event Report from Braidwood Generating Station is being transmitted to you in accordance with the requirements of 10CFR50.73(a)(2)(iv) which requires a 30-day written report.

This report is number 91-003-00; Docket No. 50-457.

Very truly yours,

K. L. Kofron
Station Manager
Braidwood Nuclear Station

KLK/DN/clf
(226/ZD85G)

Enclosure: Licensee Event Report No. 91-003-00

cc: NRC Region Ill Administrator
NRC Resident Inspector
INPO Record Center
CECo Distribution List

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